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Hand Gesture Recognition Using Mouse Event

Dr.Sinkar.Y.D**, Shivani Bhore**, Prashant Deokate**, Aishwarya Nimbalkar**, Ketan Parkale**

*(Assistant Professor, Computer Engineering, SVPM's College of Engineering Malegaon(bk), Baramati
Email: hodcomputer@engg.svpm.org.in)

**(UG Students, Computer Engineering, SVPM's College of Engineering Malegaon(bk), Baramati)
Email:shivanibhore55107@gmail.com,nimbalkaraishwarya945@gmail.com,ketanparkale33@gmail.com,prashantdeokate9393@gmail.com)

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Abstract:

Today, computer vision has advanced to the point where a machine can recognize its user with the help of a straightforward image processing programmer. People currently use this vision in many areas of daily life, including face recognition, color detection, automatic cars, etc. In this experiment, computer vision is used to create an optical mouse using hand gestures. The computer's camera will read the image of various hand gestures made by a user, and the computer's mouse or cursor will move in accordance with the movements of the gestures. Users can even make right and left clicks using various gestures.An additional functionality can be also added so that user can perform same operations by using his eye and face movment.It will function without a wire or other external devices as a virtual mouse.The only piece of hardware for the project is a webcam, and Python is used to program on the Anaconda framework. Here, the convex hull defects are first produced, and then an algorithm is generated and maps the mouse functions to the defects using the defect calculationsThe computer will understand the user's gesture and react properly by mapping a few of them with the mouse.

Keywords—Artificial intelligence, Media pipe, Convolutional neural network, Autopsy.

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I. INTRODUCTION

The proposed AI virtual mouse system is an innovative solution that uses hand gestures and hand tip detection for performing mouse functions in the computer using computer vision. This system offers a range of benefits, including the ability to operate a mouse without requiring a traditional mouse device. To implement this system, a machine learning model can be trained to recognize specific hand gestures and hand tips, captured by a web camera or built-in camera, and use them to perform mouse functions such as cursor movement and scrolling. The model can be trained using a large dataset of hand gesture and hand tip images to accurately recognize the different hand movements made by the user. Once the model is trained, it can be integrated into a software application that generates a virtual mouse cursor based on the user's hand movements. The user can then control the

cursor using various hand gestures and hand tip movements, such as moving the finger up and down to scroll or pointing to move the cursor. The proposed AI virtual mouse system offers several advantages over traditional physical mice. Firstly, it does not require any additional hardware, as it uses only a web camera or built-in camera that is present in most modern devices. Secondly, it provides an intuitive and natural way to interact with a computer, as users can control the cursor using hand movements that closely mimic real-world actions. In conclusion, the proposed AI virtual mouse system has the potential to revolutionize the way we interact with computers by enabling users to perform mouse functions using hand gestures and hand tip detection captured by a web camera or built-in camera.

II. LITERATURE SURVEY

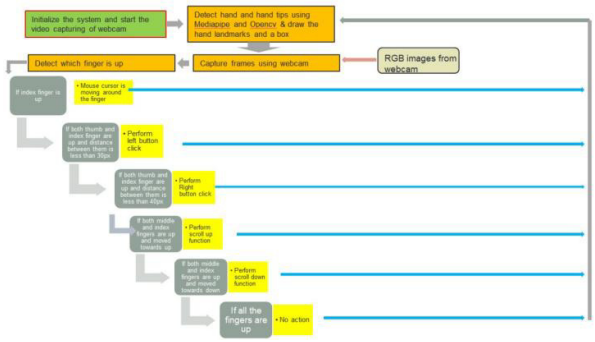
The study mentioned various approaches that involve the concept of Image Processing and Image Acquisition to create a virtual mouse, which saves manual work. The main objective of the virtual mouse is to interact the real world with the digital world using Sixth Sense technology. Many works have been done using Sixth Sense technology, and some even use Iota interaction. Smart Image attendance-based systems are also in use nowadays, which makes the attendance system more error-free and less time-consuming. Image processing tools and algorithms are used for student face detection. In the field of medical science, the use of machine learning and Artificial Intelligence is growing at an extraordinary pace, and image processing is used to classify heart attack traits. The study also included the use of mouse by color recognition, which works with color-coordinated finger caps. The image captures the color and coordinates or maps the mouse with its position concerning the location of the finger caps. However, the study mentioned that the right-click and left-click functions were difficult to perform using this process. In conclusion, the study highlights the importance of image processing and image acquisition in creating virtual mouse systems. The use of Sixth Sense technology can enable real-world interaction with the digital world, leading to innovative solutions in various fields such as medical science and attendance systems. However, further research is needed to improve the functionality of the virtual mouse, particularly in performing right-click and left-click functions using color recognition. The techniques that included the concepts of image processing and image acquisition were used. The study's guiding principle is to create a virtual mouse that is primarily helpful for reducing manual labor. This straightforward image processing method can be used in future modifications to enable complicated mouse operations. By using the idea of this technology known as Sixth Sense, the actual world is interacting and working well with the digital world. Sixth sense technology is used in many works; some even use IOT engagement. These days, smart picture-based attendance systems are also in use, making the attendance process faster and less error-prone. To identify students, image processing tools and algorithms are used. The use of artificial intelligence and machine learning in the medical field is expanding incredibly quickly. Image processing is used to identify heart attack traits. Use of the mouse by color identification, which entails operating the mouse with color-coordinated finger caps, was another of the numerous projects that have been undertaken in relation to this Sixth Sense Technology. The image records the color and coordinates or tracks the mouse's position in relation to where the finger caps are located. The only issue was that this method made it very challenging to use the right click and left click functions.

III. OBJECTIVE

The proposed AI virtual mouse system aims to develop a more intuitive and natural way to control the mouse functions by tracking hand gestures using computer vision. The system would use a web camera or built-in camera to capture images of the user's hand and plot landmarks on it to identify the position of the fingers and palm. The system would then classify the hand gestures based on the position of the landmarks and use them to control the mouse pointer and its operations such as left-

click, right-click, and scrolling function. This would provide a more intuitive and natural way to control the computer mouse, especially for users who may find it challenging to use a traditional mouse. The system would leverage the capabilities of computer vision and machine learning to recognize hand gestures accurately, making it more efficient and reliable. The proposed system would be an excellent alternative to traditional mouse systems and could potentially enhance the user's experience by providing a more intuitive and natural way to control the computer.

IV. ARCHITECTURE



1.The architecture for hand gesture recognition using mouse event can be divided into four main components:

I. **Hand Tracking**: The first component is hand tracking, which involves detecting and tracking the user's hand in real-time using a camera. This can be achieved using computer vision techniques such as background subtraction, skin color detection, or Hear cascades.

II. **Landmark Detection:** Once the hand is tracked, the next step is to detect the landmarks on the hand, such as the fingertips, knuckles, and wrist. This can be done using machine learning techniques such as convolutional neural networks (CNNs) or support vector machines (SVMs).

III. **Gesture Classification**: After detecting the landmarks, the next step is to classify the hand gestures. This can be achieved using machine learning algorithms such as k-nearest neighbors (k-NN), decision trees, or artificial neural networks (ANNs). The system should be trained with a dataset of hand gestures to accurately recognize the gestures in real-time.

IV. **Mouse Control:** Finally, the recognized hand gestures can be mapped to mouse events such as left-click, right-click, and scrolling. This can be achieved using libraries such as pyautogui or using low-level operating system functions to simulate mouse events. Overall, the hand gesture recognition using mouse event architecture involves capturing the user's hand gestures through a camera, detecting and tracking the landmarks on the hand, classifying the hand gestures, and mapping them to mouse events to control the device.

2 .MediaPipe: MediaPipe is a Google open-source framework that is used for deploying in a machine learning pipeline. Since the MediaPipe framework was created using time series data, it can be used for cross-platform programming. The MediaPipe architecture supports multiple audio and video formats because it is multimodal.

3.OpenCV: OpenCV is a computer vision library that includes object detection picture processing algorithms. Real-time computer vision apps can be created by utilizing the OpenCV library for the Python programming language. The OpenCV library is used for analysis such as face and object recognition in image and video processing.

4. Autopy: AutoPy is a straightforward, cross-platform Python tool for GUI automation. It has tools for managing the mouse , locating colors and bitmaps on the screen, and showing alerts.

V.EXPECTED RESULT

The expected result of hand gesture recognition using mouse events is to accurately detect the hand gestures and translate them into corresponding mouse actions. For example, if the user makes a "click" gesture with their hand, the system should register this as a left-click and perform the corresponding action, such as selecting an item or opening a program. Similarly, if the user makes a "swipe" gesture, the system should detect this and move the mouse cursor in the desired direction. Other gestures, such as "pinch" or "spread" gestures, can be used to zoom in or out of an image or webpage, and the system should be able to recognize these and perform the appropriate action. Overall, the expected result of hand gesture recognition using mouse events is a seamless and intuitive user experience, where the user can control their computer using natural hand gestures rather than a physical mouse. The system should be accurate, responsive, and reliable, with minimal delay between the gesture and the corresponding mouse action.

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VI. CONCLUSIONS

It is true that the main objective of the AI virtual mouse system is to provide an alternative way to control the mouse cursor functions by using hand gestures, which can be beneficial for people who have physical disabilities or for situations where a physical mouse is not available or practical. Additionally, the proposed system can contribute to reducing the spread of COVID-19 since it allows for hands-free control. It is also important to note that the proposed model has demonstrated better accuracy compared to existing models, which makes it a promising solution for real-world applications. However, as with any technology, there are limitations that need to be addressed. The slight decrease in accuracy in the right-click mouse function and difficulties in clicking and dragging to select text are areas that need improvement. As mentioned, improving the fingertip detection algorithm can help address these limitations and provide more accurate results. This can be achieved by incorporating more advanced image processing techniques or using more sophisticated machine learning algorithms. Continuous improvement and testing of the system can lead to a more reliable and effective solution for hand gesture-controlled virtual mouse technology

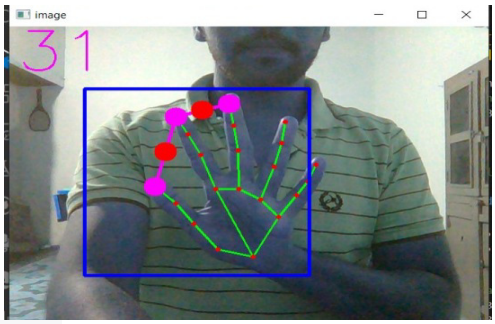

Figure :Rectangular box for the area of the computer screen where we can move the cursor.

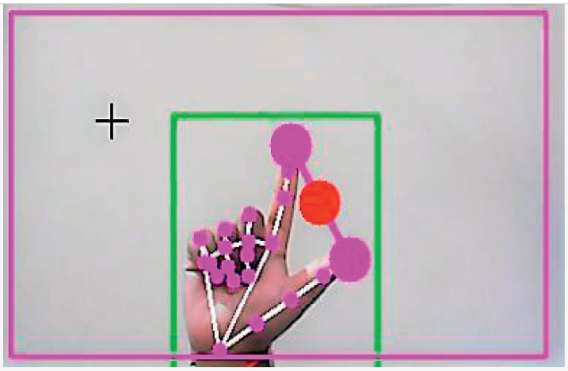

Figure : Gesture for the computer to perform left button click

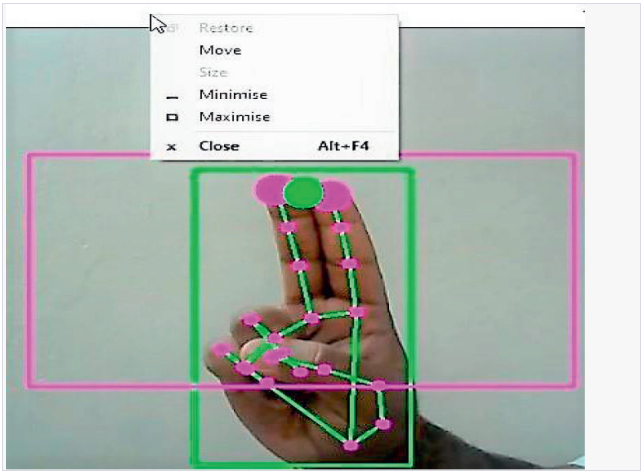

Figure:Gestureforthecomputertoperformrightbutton click.

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